The Science Teacher

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HAMILTON HYDROMATIC PROPELLER LENDS ITSELF TO CLASSROOM USE. *(Official U. S. Army Photo)*

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ON SUBJECTS YOUR STUDENTS WILL ASK YOU ABOUT

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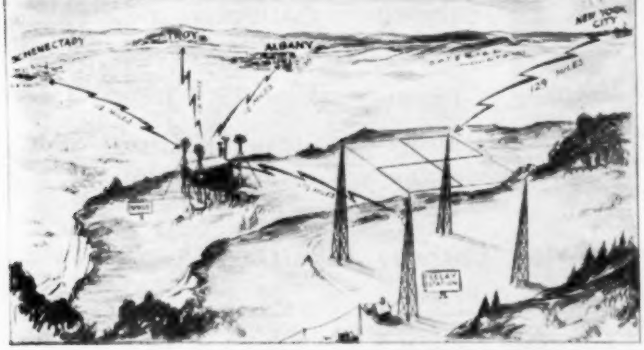

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The Science Teacher

VOLUME XIV FEBRUARY, 1947 NUMBER 1

Recruiting and the Economic Status of the Science Teacher

RALEIGH W. SCHORLING
School of Education, University of Michigan

The first three articles of this journal present part of a forum discussion of "Problems of the Science Teacher" by members of the Cooperative Committee of the AAAS at the December meeting at Boston of the National Science Teachers Association. Following these papers by Professor Schorling, Dr. Quill, and Dr. Meister we expect to present in the next issue of *The Science Teacher* the discussions given by Professor K. Lark-Horovitz of Purdue University and by the forum moderator, Professor A. J. Carlson, University of Chicago. The problems presented here are ones with which all science teachers are vitally concerned.—Editor.

OUR SCHOOLS are threatened by a drastic shortage of teachers. The facts about our teacher shortage are deeply disquieting and altogether convincing to thoughtful parents and discerning citizens. Many teachers are leaving our classrooms—over 600,000 have quit teaching since 1939, of which about 300,000 were teachers of long experience. In the war years teachers were very useful in many branches of the Armed Forces. They learned that they were good at other jobs that offered larger salaries and greater freedom.

A strong teacher of science has competencies and personal qualities that are much in demand in industry and business. The October, 1946 number of *Fortune* prints a dramatic interview between Mr. Marshall, president of Raytheon, and a brilliant young physicist from MIT. The physicist asked what he would be expected to do at Raytheon. Whatever you like! He asked how much he would be paid. Whatever you like! The story, though a bit exaggerated, suggests the opportunities in industry for young men trained in science.

The beginning salaries in some cases may be about the same. But the life expectancy of total earnings is several times as great for the young scientist in industry as that which he can earn as a classroom teacher of science.

It is not surprising that young persons are rejecting teaching as a career. This is the alarming fact. At the end of the last school year (1945-1946) the enrollment in teacher training institutions was about one-half of what it was in 1920. This year nearly all colleges and universities are overflowing, but only a few of the students per hundred are planning to teach. When at the graduating exercises at the University of California at Berkeley in June of this year, the graduates going into the teaching profession were asked to stand, only fifteen stood up! Last year the University of California at Los Angeles had over 2,600 requests for teachers, but last June this school granted only thirty teacher's certificates.

The situation as regards future teachers of science is especially deplorable. Of the 119,801 undergraduate students enrolled in the present year at eighteen prominent teacher training schools[1] only 307 students will receive the teacher's certificate in science or mathematics. The prospect for some sort of teachers in other school subjects is of course better but still bad enough to be truly frightening. Of the very small number of seniors in all our training schools, who are taking the courses qualifying them for the teacher's certificate, many will not even start teaching, and of the rest the majority will almost cer-

1—University of Michigan, Eastern Illinois State Teachers College, Indiana State Teachers College, Michigan State College, New York State College for Teachers, New York University, George Peabody College for Teachers, Purdue University, University of Alabama, University of Iowa, University of Oregon, University of Southern California, University of Wisconsin, University of Nebraska, University of Virginia, Iowa State Teachers College, Greeley Teachers College, University of Kentucky.

tainly quit before the end of three years. Keep in mind that young men nowadays earn enough money for marriage very early in life. The type of young woman who used to teach—in many cases quite effectively—for about three years, now is likely to get married within a year of her graduation from college. As has been suggested, the young men in science courses are attracted so early by industry that they do not even bother to qualify for the teacher's certificate. In the vast student body at the University of Michigan (18,500) there is only one senior planning to teach physics and only one in chemistry. Moreover, there is no assurance that these two men will be in science classrooms next fall. The stream of young people that used to flow into the teaching profession has just about dried up.

THE QUESTION is, what can we do? The answer, of course, is that we must make teaching more attractive for our youth. How can we make teaching a desirable profession for the students in our high schools and colleges? By taking out of the picture those things that now cause youth to turn away from teaching. What are the main reasons why young people reject teaching? Low salaries are a basic reason, but there are about a dozen additional reasons why young people are choosing other fields of work. Most of these relate to the working conditions of teachers.

Let's look at some of these reasons. Consider first the matter of salary, not because it is the most important factor but is the one that is most easily understood. The Nation's Capital is a good spot to study the shocking picture of teachers' salaries. For the year 1944-45 the average teacher's salary for the District of Columbia was $2,619, whereas the median salary of the vast number of professional employees of the Federal Government in 1944 was $3,560. The federal employee gets almost $1,000 more! But this average does not tell the full story. A teacher in the high school, who had taught successfully for twenty years or more, received $3,700 as a maximum. In sharp contrast the professional employee of the Federal Government received anywhere from $6,020 to $9,800 as a maximum. The recent increase in the federal salary scale has widened the gap. The teaching profession includes an astonishing number per hundred who labor with high competence and missionary zeal regardless of the level of their compensation. For that we are grateful and proud, but a million persons do not year after year give themselves to any calling without appropriate salary. What really happens is that many of our best prospects for teaching are attracted by better paid jobs in industry, in commerce, and in the other professions.

Shameful as the salary situation is, it will nevertheless be a fatal mistake if we assume that we can get enough good teachers merely by doubling the salary of every teacher. The working conditions of classroom teachers, resulting from our efforts of mass education, are now intolerably bad in many schools. A teacher has too many classes—25 to 30 per week is common practice; a teacher has too many pupils in a class—25 pupils is considered a fairly small class and 30, 40, 50, even 60 per class are not uncommon; a teacher has too many duties on top of a full class load—supervising extra-curricular organizations, coaching teams, counselling home rooms, preparing assembly programs, supervising study halls, policing corridors, counselling problem cases, and participating in community affairs; a typical teacher does not have good materials needed in instruction, or at any rate, does not have enough—too often a teacher is expected to perform miracles with nothing in the classroom beyond a textbook, and even that may be hopelessly out-of-date; a teacher does not have enough guidance on the job—the right kind of supervision, which helps the teacher plan his work, aids him in providing good materials and insures that he grows on the job, has practically disappeared. To the beginning teacher the task of finding his way alone is too often a torturing nightmare; a teacher is not given the necessary time in the school day, nor paid in the summer months for the extremely difficult task of keeping the curriculum up-to-date.

FINALLY, many young people have the deep conviction that teaching is not highly regarded by the public. A society that spends about two and one-half times as much for liquor and three times as much for cosmetics

as for its schools is obviously not too much concerned about the teachers of its children. Our young people fully realize that the issue is one of values. Naturally they do not wish to give their lives to something that is rated so low by their fellow citizens. Moreover, the problem is complicated by the fact that we no doubt have tens of thousands of teachers who are so incompetent that they do not earn the meager salary they now receive. In fact, such persons would not be teaching if we really cared about our schools. There is no greater fiction abroad than the notion that the American people have been generous in the financial support of their schools. We must spend as much for schools as we do now for liquor. We must spend at least half as much for schools as we do in the care of criminals and delinquents. Then we can add a million additional teachers and thus do away with the expectation that each teacher do the impossible job of two persons; then we can improve working conditions of teachers and thus make teaching a challenge and an inspiration; then we can take steps to give due recognition to the gifted teacher and thus differentiate between the professional worker and the mere transient; then we can attract the best of our young people and thus screen out the incompetent teachers with weak personalities that now downgrade what should be a great profession; then we can hold a desirable number of men in both the elementary and high school grades; then we can insure that a reasonable number of the teachers of our children—let us say one-half of them—will be really good; then we can feel confident that this nation will continue to grow strong in its influence for a better world.

The Laboratory Problem of the Science Teacher

MORRIS MEISTER

High School of Science, New York City

INDIVIDUALIZED laboratory work in the high school sciences has not made the progress during the past two decades which one might expect from the increasing contributions made by research in the basic fields of the sciences. In fact, some of us feel that there has been a retrogression. Have new buildings included enough space for laboratories? Are existing laboratories used to the fullest extent by high school science teachers? Reports from various parts of the country indicate that individualized laboratory work has sometimes been altogether omitted. Riddle,[1] in his exhaustive study of the teaching of the biological sciences in the secondary schools of this country, has found that there is little or no time for field work and also that in many cases laboratories are either poorly equipped or inadequately used.

Any consideration of science and its potential contributions to education must include laboratary experience as a vital preparation for both research and teaching. Certainly the scientist cannot function properly without it. Nor can the science teacher make his message meaningful unless he bases it upon laboratory findings and field work. Why then can the high school program ignore the laboratory?

THIS LACK of progress in individualized laboratory work in high schools is a serious matter. It is especially serious in an atomic age in which we must rely upon high schools for most of the general education of its citizens. We may afford to lose some of the subject matter and content now present in science textbooks and syllabi. But we cannot afford to lose the experimental approach in solving problems, be they in the material world or in the human social field. Only in and through the laboratory and field observations can we develop in individuals that desirable attitude which tends to base belief and conviction upon an evidence-gathering process. When our non-science teaching colleagues seek means for integration in the curriculum, they rarely have in mind specific science subject matter. They almost always turn to science for examples of critical thinking based upon fact and experiment. If, then,

1—Riddle, Oscar; Fitzpatrick, F. L.; Glass, H. B.; Gruenberg, B. C.; Miller, D. F.; and Sinnott, E. W. *The Teaching of Biology in Secondary Schools of the United States.* A report of results from a Questionaire. The Committee on the Teaching of Biology of the Union of American Biological Societies, 1942.

we abandon individualized laboratory work, we shall succeed in cutting the heart out of the contribution which science can make to general education.

Laboratory equipment not only costs money, but requires somebody's time after it arrives in the school. Equipment must be ordered, inventoried, stored, arranged for use, repaired and stored away again in good order for future use. Who is to do this work? School administrators and Boards of Education expect of the science teacher the same teaching load as is expected of all other teachers. Is it any wonder then that science teachers are reluctant to develop individualized laboratory work? Most of them have all that they can do in getting demonstrations ready. Even this is a drain upon the teacher's time which is hard to keep up with, though it involves but one set of equipment.

SOME recognition is made of this problem in a few large public school systems. In the New York City public schools, for example, laboratory assistants are added to the staff in the ratio of one assistant to every seven or eight full-time teachers of science. Having watched this arrangement closely for over twenty years, we conclude that even this gesture is inadequate for sound education in science. A healthy program of laboratory work would require a ratio of one assistant to every four or five teachers. Unless we can convince and prevail upon budgetary authorities to provide this needed manpower, science cannot realize its investment in laboratory work.

It is futile to proclaim that American democracy in an atomic age can be made even relatively secure by education for all American youth and that science must have an important place in that education, nor can we insure our country's future through cultivating its science talent, unless we provide schools with the wherewithal for giving all youth opportunity to become acquainted with the method of science in the laboratory. Finally, our teacher-training institutions must develop a generation of science teachers steeped in laboratory lore and with competence that will require laboratories for its expression. Only in this way can we bring to an end the long, lean years we have experienced in high school science laboratories.

Reflections on Science and Liberal Education

LAURENCE L. QUILL

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TO THE layman it might seem that insistence on laboratory experience is necessary only for the college preparatory course, but just the contrary is the case. The large majority of high school graduates who do not enter college must obtain science experience in the secondary school as part of their general education.

Interwoven into current discussions regarding educational matters are thoughts concerning the provision of a broad foundation which will better prepare our youth to cope with personal, family, vocational, social and civic problems. This broad foundation must include a study of man's relationship to his physical, biological, and social environment, and a knowledge of the development of our modern civilization.

Science means a variety of things to different people. Some think only of the glamour resulting from outstanding discoveries, while to others it means development of precise methods of observation and their logical interpretation. Science attempts to understand nature, to analyze and appraise the facts. Science is not technology. Yet the two develop in parallel because the former furnishes the "know-how and why" so essential to the latter.

Man as a social being, living in this physical world with its technical advances, needs scientific training in his educational program.

Science plays a dual role in the educational process: (1) the liberal education of the scientist and, (2) science training in the liberal education of the non-scientist.

SCIENTISTS are increasingly realizing the importance of a liberal education program for the prospective scientist. We who plan with these particular students should urge them to broaden their program of study, (1) so that they may become aware of the current social, economic, and political problems, (2) so that they may gain sufficient historical background regarding the development of civilization, (3) so that they may understand the methods used for the solution of problems in the past, and their influence on the development of current situations, and (4) so that they may recognize their responsibility for contributing to the solution of social problems. The scientist can no longer ignore the economic, social, and political community which surrounds him, and he must be prepared to act as a participating member of this community.

Courses provided in the general education curriculum for the potential scientist should not be superficially encyclopedic in nature, but should stress the basic concepts underlying a social philosophy.

The science instructor on the other hand, has a vital obligation in supporting the liberal education program of the non-scientist. He must cooperate so that this program will include the scientific fundamentals essential for the layman. He must endow the non-scientist with the philosophy and methods of science to an extent which will bring about the habitual use of the scientific method for the solution of problems in other fields of endeavor. I am sure that no man will question the desirability of habitually formulating a clear statement of a problem, the desirability of unbiased investigation and study of observed facts, and the desirability of continued openmindedness acquired from experimental procedure. To achieve this purpose, so essential for the student, it will be better to study thoroughly a few problems, carefully selected, than to have "filled in all the blanks" of a laboratory manual without having given a thought to the philosophy and methods of science.

THE SCIENCE teacher has an obligation, as L. W. Taylor of Oberlin has expressed it, to show that the "practical aspects of the sciences are not to be despised, that their significance lies not so much in the multiplicity of inventions which makes the world so different and life so much safer and easier than it was a century ago, as in the subtle conception of Man's confidence in his intellectual supremacy over nature."

Tomorrow's science will provide the foundation, the strength for a peaceful world. Tomorrow's scientists need a liberal education and the maximum opportunity through good teaching, with modern equipment, and most of all through inspiring leaders to become the leaders in their chosen scientific fields.

But it is just as essential that the layman be able to apply the methods of science to the solution of his diverse problems, and that he have a background for the wise interpretation of the developments of science.

IN THESE last few moments, we have reflected ideas from only a few of the many facets about the interrelationship of science and a liberal education. We will close by quoting Professor Carlson of the University of Chicago: "Science has indeed disturbed the traditional humanities, not so much by crowding the curriculum as by questioning ancient and easy answers and interpretations. Science bows to no man, not even to the 'hundred great books' of the past. Yes, science is an iconoclast, a disturber of faiths and dreams, a challenger of nostalgia. But science is a product of man, and science changes significant parts of man's environment faster than does raw nature. Science creates new problems important in the lives of all the people. The science core in liberal education must provide an understanding of these changes and problems lest we perish."

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Editorial and News

Are We Limiting Opportunities for Youth?

JOHN C. CHIDDIX

What do we offer youth in science? In a world increasingly dominated by scientific technology, are students given an opportunity for growth in science in keeping with the requirements of our time? There is increasing evidence to show they are not; and it is well to examine the evidence.

Studies (Riddle and others) show that grade and high school classes do not offer the challenge nor the experiences necessary to stir interests, bring satisfactions, and make students conscious of latent abilities in science work. Too much instruction is based on demonstration and too little on first hand experiences with the tools of science in a laboratory. It is a demonstrated fact that experiences are needed for the development of talent in science. The boy who looks over a fence to see a tractor working in a field will find the occasion interesting, but the boy who climbs over the fence and operates the tractor is likely to insist on having one for his own. Too many of our talented youth just look over the fence in science and miss the opportunity of becoming enthralled with it and fired with a consuming ambition to use the tools of science in solving problems of their own and on their own initiative.

At the recent meeting of the Junior Scientists Assembly sponsored by the National Science Teachers Association at Boston, the young scientists recognized the experiences which spurred them on to further learning in science or to science as a profession. They pointed to laboratory experiences that were meaningful and challenging. Further, they pointed out that the most vitalizing thing was the solving of their own problems on their own initiative. Whether they failed or whether they succeeded was not as important as the fact they used the methods and materials of science and had tried out their own ideas.

But a teacher may say, and rightly, "I do not have time as a science teacher to give students attention with individualized laboratory work, or to allow students to solve special laboratory problems, or to do projects of their own choosing." It is true there are too many hours for nearly all science teachers and too heavy a student load. (See *Time for Science Instruction*, 1946 Yearbook of the National Science Teachers Association.) More time for instruction in science should be one of the major goals toward which all teachers as a group should work. When we limit laboratory opportunities, we are definitely denying to youth adequate learning experiences.

Again we note that students are denied opportunities in science because many potentially great teachers of science as well as a number of those now teaching are going into other fields. The science teacher's income is too meager in comparison to what he could earn in other occupations; his teaching load is too heavy. (Read the facts in Professor Schorling's article in this issue of *The Science Teacher.*) The result is an increasing shortage of able and adequately trained teachers and a loss in opportunity for students.

There is a vast difference in being kept in a classroom to study a text and a manual that must be followed; and in being guided in an exploration of science and in the learning of principles to be used in solving interesting problems. Poorer science teaching can only mean less development of latent science talent.

And who is responsible for denying adequate science training? We believe the responsibility lies partly with the administrator, a part of whose job it is to enlist sufficient support for the schools; and lies partly with the American public which has been slow in recognizing the need for quick action in time of economic stress. Science teachers' organizations can do much to correct the situation.

To be specific in dealing with this problem we raise the question, "What are you personally willing to do through your organization to solve this teaching problem and to meet the needs of youth?"

A United Effort for Science Legislation

The American Association for the Advancement of Science, by vote of its Council at the Boston meeting in December, will sponsor a joint effort of many national organizations of scientists to plan and present recommendations for legislation in the Eightieth Congress toward the establishment of a Science Foundation. Through this Foundation, Federal funds would be used to support scientific research for the protection and welfare of our Nation.

Bills to this end were introduced in the Seventy-ninth Congress, but they failed to pass. It was discovered that scientists themselves were not agreed upon the purposes and the administration of the Foundation, and compromises did not appear to be satisfactory. With the experiences gained through the discussions of the controversial matters (such as the ownership of patents, the establishment of scholarships, etc.) and with the counsel of a wider group of scientists, it is believed that satisfactory measures may be prepared for the consideration of Congress.

The National Science Teachers Association, through its officers, will join in the conferences relating to the proposed measures. Teachers have a special interest in the plans that may be laid for training the future research scientists, and for the most part they believe the scholarships proposed in certain of last year's bills is a wise provision.

The National Education Association will again offer measures for the Federal aid to schools to equalize educational opportunities throughout the nation. With the counsel of the N.E.A. officers, it is expected that a revised version of The High School Science Education Act will be prepared, and introduced at a propitious time. This Bill (Senate Bill 1316) was offered in 1945, but was never reported out of the Committee on Education and Labor.

NSTA Elections

THE GOVERNING Rules of the National Science Teachers Association provide that elections shall be held annually by a mail ballot. It is further provided that the ballots received are to be counted and the elections closed as of May 10th of each year.

The Governing Rules also specify that the Nominating Committee shall write consultants inviting suggestions for nominations for NSTA offices. This procedure has been carried out fully in all elections held. To go back only one year, the Nominating Committee in 1946 received over 100 letters in response to requests for suggestions for candidates. In its deliberations in St. Louis in March, 1946 the NSTA Nominating Committee took full cognizance of the summarized suggestions received from consultants and other members who had shown enough interest to write. The suggestions received were a major factor in guiding the decisions of the Nominating Committee.

The Committee decided that the large number of suggestions received justified the procedure of listing only one candidate for each major office. A number of choices were on the ballot for directors of NSTA.

As the election ballots were received by the Secretary, all comments were written down and later duplicated for distribution to members of the Board of Directors. Some of these comments indicated a lack of understanding of the use which had been made of a large number of suggestions received by mail before the Nominating Committee selected its candidates. The Nominating Committee for 1947 is likewise receiving written suggestions from the consultants representing each of the organizations affiliated with NSTA. The Nominating Committee further invites written suggestions from all members. Send your suggestions to Robert H. Carleton, Summit High School, Summit, New Jersey. Mr. Carleton is Chairman of the 1947 Nominating Committee. Other members of the Nominating Committee are: A. O. Baker, Board of Education, Cleveland, Ohio; Ellis Howarth, Washington, D. C.; Ira C. Davis, University of Wisconsin, Madison, Wisconsin; Will Burnett, San Francisco Teachers College, San Francisco, California; T. A. Nelson, Lyons Township High School, LaGrange, Illinois, and Elbert E. Headlee, Kirkwood High School, Kirkwood, Missouri.

Science Teaching Packets*

BERTHA E. SLYE

National Science Teachers Association, Washington, D. C.

BERTHA E. SLYE

THE PROBLEMS of a teacher in a rapidly changing world are immense and staggering. His opportunities for leadership are unlimited, but his responsibilities are greater and often outweigh the opportunities to the point of being a burden. He must:

1. Keep informed on the many changes in contemporary living;
2. Keep a true perspective of the educational problems in spite of the changes;
3. Read objectively and select with discrimination those items of interest to him and pertinent to his teaching, and
4. Streamline his classroom technique to make effective use of the information.

The selection and effective utilization of source materials is a major problem, one that necessitates a careful and intelligent study and takes time which the teacher does not have. To effect real economy he resorts to the use of good digests or collections of materials containing the best available current information. Thus we are finding teaching packets on the front of many educational departments.

What Is The Science Teaching Packet?

In brief, it represents an attempt of selected members of your association to collect and evaluate for business and industry, and distribute to you top quality commercial supplementary science teaching aids. These aids include booklets, radio talks and reprints of science magazine articles for the purpose of giving the teacher a digest of some of the developments of scientific research, and to provide the students with supplementary information on science in contemporary living.

How Did It Begin?

Good science teachers have always had a yen to keep up-to-date by making their teaching functional and vivid in terms of things actually around them. They fought the barriers inherent in text and reference books and realized that no book regardless of its quality and current value can be kept up-to-date with the speed of modern science. So, for a long time they have been pouring in requests to industries for booklets and pamphlets on new products and processes. As a matter of fact, many of the educational departments of industries first came into existence in order to satisfy the science teacher's demands for reports on new discoveries. Industry has been quick to realize its opportunity of helping the schools to keep informed on scientific progress, and to help improve the general scientific literacy of the teachers. Educational consultants thoroughly conversant with classroom procedures and problems were employed to produce materials of educational value.

AS MORE public relations departments of industries began to think in terms of educational programs and the production of materials designed for classroom use, more commercial materials became available to teachers for the asking and the price of postage. Now some 400 companies provide free and low-cost supplementary teaching aids, most of which are valuable in the teaching of science. And, at present there are at least ten companies producing lists of resource materials.

The more plentiful the aids became the more critical the teacher became. He set up his own standards for the evaluation of them

*Talk presented by Bertha E. Slye, Director of Membership Service of the National Science Teachers Association, at the Association for the Advancement of Science meeting in Boston, Massachusetts.

as suitable classroom aids. The problems of effective utilization increased, and were turned over for study to local and state committees. Finally these problems became of paramount interest to our Association and members of public relations departments of industries and of such scope that a serious and intensive study began.

Many preliminary projects by the Association were woven into its objective study of the problem before the actual work on the science teaching packet began in Washington. All of these activities have made a valuable contribution to the successful beginning of the work, and have been responsible for an almost unbelievable program of achievements during this three-month period.

FIRST, during 1945-46 our Association worked out under Dr. Harold Wise, a report on *Specifications for Commercial Teaching Materials for Science.*[2] It was prepared for the Secondary School Principals at the request of the Consumer Education Study Committee which financed the project and offered suggestions without in any way dictating the content. The committee indicated several things in the report:

1. What teachers want to help them make their instruction more effective.
2. Criteria for acceptable materials.
3. Suggestions for physical and content specifications of the offerings.
4. Information to producers of commercial materials giving grade levels for which materials on each topic should be prepared.

Next, our Association consulted with the U. S. Rubber Company in the production of a booklet *Serving Through Science*, a collection of radio talks given over NBC by American scientists. We were able to secure 5,000 copies of this booklet and all expenses incident to the distribution to our members. You may be interested in knowing that to date some 800 teachers have requested additional copies, ranging from one to three hundred each.

With the cooperation of DuPont de Nemours and Company we were able to distribute 5,000 copies of the booklet on *Plastics* to all of our members. The response to this distribution was equally favorable.

Finally, our Association received a grant-in-aid from General Motors Corporation for the development of cooperative projects between the Science teachers and industry, and your speaker was invited to come to Washington to arrange for the proper negotiations.

What Is Happening In Washington?

The developments have moved rapidly since October 9, the beginning date of the project. Some 100 companies out of a possible 400 were invited to participate by sending ten copies each of available booklets or articles on scientific products and processes. With few exceptions all companies have responded. A committee of our Association was selected by your President to evaluate the materials with the possibility of including them into a science teaching packet. To date some 30 items with rating scales have been submitted to the committee.

Conferences have been held in Washington with representatives of 16 companies, and 8 others are on the agenda list for the first two weeks of January. Since coming to Boston, conferences have been held with representatives of 12 industries. Negotiations have begun with those companies involved in the production of acceptable items. Such negotiations mean a plan for the distribution of packets containing from six to eight items each from our central office in Washington, with all expenses incident to the cost of distribution borne by the companies involved.

What of the Future?

WHAT CAN WE predict for the growth of our Ascociation with a project of this sort? First, let it be said that the strength of any association is measured by the qualitative interest of its members in those projects that stimulate their continuing intellectual and professional growth. Therefore, it is reasonable to suppose that informative materials on modern research can activate the interest of science teachers. Such informations helps to enrich their background and make their teaching functional in terms of the relation of the fundamental concepts of science to applied

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2—Report was published by the National Better Business Bureau and distributed to its members.

Science for Society

EDITED BY JOSEPH SINGERMAN

• A department in which science is presented in its close relationship to the individual and in which guidance is given in causing the individual to recognize the methods of science and its vast social implications.

THE COMMONPLACE accusation of talking about what should be done but doing nothing about it most assuredly does not apply to the Fieldston School of the Ethical Culture Society of New York, at least so far as teaching social impacts of science is concerned. Many of us succeed in weaving this theme tangentially into the orthodox curriculum. That is, of course, commendable practice. But, Mr. Philip Kotlar, in charge of biology at the school, offers a regular elective course, which he calls *Science and Society*. It receives a full unit sociology credit toward college admission. In organizing and planning this course, still in the experimental stage, Mr. Kotlar has had the helpful cooperation of Miss Elizabeth Day and members of the History Department of which she is chairman. In giving the course, there was active participation, as well, from individual members of the departments of Classical Languages, Art, Mathematics and Physical Science.—J. S.

Science for Freedom—An Experiment

PHILIP KOTLAR

Fieldston School, New York

IN ALL OF man's history, there has probably never been a time when so many people have been concerned directly or indirectly with the ideas and applications of science. All of us have been brought closer than ever before to the realization that we can use science constructively as well as destructively. There is also more conscious awareness of the discrepancy which exists between our technical developments and our social progress. Some of our colleagues speak of this discrepancy as cultural lag. There also seems now to be more anxiety, as well as willingness, to deal more adequately with some of the social implications of these technical developments. The very formation of an organization such as the United Nations Educational, Scientific, and Cultural Organization (UNESCO) attests to this assumption. Looking at the brighter side, wouldn't we all agree that more than ever before there are at present tremendous potentialities existing for greater human freedom?

Yet in spite of the technical and intellectual possibilities which exist we find populations of people in need of the basic necessities for minimum survival. We find conflict, confusion and selfishness existing side by side with verbalization about one world and the construction of a United Nations Organization. We are living in a time of tension, re-examination and transition. Many of us are optimistic about the future for we know that man has at times shown remarkable ingenuity in coming to terms with his problems. He has had to learn that cooperation and good planning are often more important than selfish, stupid obstinance.

WE ALL find ourselves buffeted by these various forces of transition, optimism, confusion and dreams of a happier world. Now more than ever before as a result of the many devices for communication (radio, press, movies, etc.) even our young people of preschool age, as well as school age, are aware of these cross-currents. They are in contact with many of the technical discoveries and have a stake in the way we use these developments.

Young people are confused. Adults are also uncertain. It, therefore, becomes the responsibility of our educational institutions to do more in the way of explaining the origin, development and meaning of science; interpret-

ing the interaction of science and society; and of suggesting directions for the use of scientific ideas and techniques in the hope that human suffering will decrease and a life of greater freedom be made possible. It becomes perhaps the unique responsibility of the science teacher to take some leadership in our schools in such matters. It is surely not the task of the science teacher alone, but the obligation of the whole school.

Some might assume from this discussion that the schools have never tried to explain science, interpret its impact or point to proper uses. Such an assumption is unwarranted for the very way in which we have taught science and the position it has held in our educational institutions indicates our attempt to define its role and function. In many schools, we have even attempted to deal explicitly with the meaning and interaction of science. It is felt, however, that we should now do more in these directions. Perhaps we should place a greater emphasis on the technical as well as intellectual potentialities of science. Perhaps as some educators have suggested we should be more concerned with the history of science. Each teacher, each school will have to make decisions about emphasis or curriculum change in the light of needs, circumstances and objectives peculiar to the individual school. It is no longer a matter of whether we ought to do anything about science and society, but how to deal with the problem most effectively. As a result of such thinking we in the Fieldston School, one of the Ethical Culture Schools of New York City, decided to set up an experimental course for twelfth grade students on the interaction of science and society. The group meets each day for forty minutes. The writer is the coordinator of the course. Other staff members, alumni, parents, students and outside specialists are called upon, for one or more periods, to lecture, lead a discussion, perform demonstrations or direct an excursion. Use is made of various audio-visual and literary aids.

IN THE first half year we start off with definitions of science and of culture. We then explain the evolution of man, his similarities to and differences from other mammals. In study of early man we are concerned with his art and magic. Through a recent book, *The Hopi Way*, we examine a present day primitive group, the Hopi Indians. We ask ourselves how we in Western civilization differ from this group.

We find that there are many differences as well as similarities. But the outstanding difference is the way in which we in Western civilization have developed the scientific method as well as scientific technology. We differ from the Hopi Indians also in our religious and economic life. In short, we are largely a capitalistic, scientific culture, in which most religious affiliations are of a Christian or similar nature.

We then begin an examination of various cultural periods, spending about two weeks on each period. The cultural eras are the Greek, Roman, Middle Ages, Renaissance through 17th Century, 18th, 19th and 20th Centuries.

We call in our experts to help us with generalizations concerning the historical and cultural aspects of a period and place special emphasis on the role of science during each era.

During our study of Greek civilization, Miss A. M. Newton, of the Classical Language Department, discussed the life of Athens during the time of Aristotle. The writer discussed Aristotle and biological science as well as the more specific economic, sociological and intellectual forces at work. Mr. Victor D'Amico, of the Art Department, interpreted, with the aid of slides and pictures, the meaning of art in Greek life. Against this background, Miss M. E. Murphy, of the Mathematics Department, helped us by demonstration reading and discussion to understand the mathematical developments of Greek and related cultures. Mr. Augustus Klock, of the Physical Science Department, portrayed the area of physical science in the Greek world. At the end of the unit we summarized the era, emphasizing the meaning of science in relation to the other cultural forces.

During investigations such as this one the students have assigned readings and hand in written reports each week on a special topic which is the same for the whole group. Readings related to the scientific work of an era

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Reorganizing Biology

To Meet the Needs and Interests of Youth

(Concluded from December issue)

It would be well to outline more specifically the subdivisions of the major areas which some of the classes study. We should consider this selection of content in the perspective of three major objectives of science teaching.

1. To give those students who will not become experts in science teaching those skills, understandings, appreciations and attitudes which will enable them to cooperate with those who are experts.
2. To provide, for those students who will become experts in science, those experiences which will give them opportunities for self-realization.
3. To provide opportunities (at the level of learning considered) for using the scientific method to solve the problems of living.

The realization of objectives 2 and 3 involve not only reorganization of subject matter, but also a reorganization or rather a modification of teaching procedures. These will be considered apart from the following necessarily brief description of areas of content.

a) *Nutrition.* Emphasis is placed here on proper diets for growth, for maintenance of the energy level necessary for efficiency, and prevention of nutritional disease. Consumer aspects, use of food, substitutes and proper preparation of food enter here.

b) *Physiology.* The function and structure of the body are emphasized here. Development of the material is pointed at that information which will be useful to the citizen—not the expert. For instance, students are not expected to have a knowledge of the different enzymes and their action, but they need to know enough to interpret advertisements on aids to digestion, etc. Cells and their structure are brought out in relation to function.

c) *Behavior.* The emphasis here is on interpreting human behavior from the infant through adolescence. The structure of the nervous system and the nature of hormones is emphasized as they are required to explain reflexes, habits, "instincts", learning and simple psychology. (Usually this work is very popular and results in establishing a "Psychology Section" which meets regularly after school). Plant behavior is usually left to "Biologic Production".

d) *Diseases.* Prevention and control is emphasized with special regard to the diseases which are particularly prevalent. Plague spots—e.g., areas in which malaria, typhus, certain tropical diseases abound are studied to recognize the problems brought on by global travel. Information on organic diseases, hypertension, heart diseases, as well as syphilis, gonorrhea and tuberculosis are eagerly sought.

e) *The Life Span.* In my experience, few students have mentioned in open discussion a desire to study human reproduction. They do want to study how animals reproduce. This is easy to understand in view of the emotional charge induced by this topic. I have found it best to introduce the topic through dissection of frogs and rats, and through breeding experiments. It is easy to make the transition from the structures of the male and female rat to those of the human. It must be emphasized that students do not ask questions about masturbation or sexual intercourse in open discussion in a mixed class. However, these questions may be asked in classes of boys or of girls. These questions are usually phrased with a candor which does credit to the student.

While the anatomy of sex organs is sufficient at the beginning, this activity develops into a valuable learning experience throughout the term. Special visits are made by individual students for discussion of personal problems. In class the pregnancy cycle, with its interesting interlocking hormone action is avidly discussed. So are sex hormones and their effects on secondary sex characteristics.

Different classes require different approaches. But suitable references and readings on human reproduction are requested by most students. Incidentally, this is a useful method to give students the information

they seek and to take the first steps in dispelling the barriers which are the result of poor conditioning in infancy and in the preadolescent stage.

Time is not wasted on the study of reproduction of typical invertebrates and plant forms which abound in textbooks and syllabi. The reproduction of the amoeba is studied when the nature of protoplasm (in mutation and physiology) is studied. But protozoa are interesting to many students and some good projects or individual laboratory work can be organized for students at home, after school, or during free periods.

In essence, attempts are made to give the student an appreciation of the development of man from the union of sperm and egg through senescence. The problems of longevity, strangely enough, find an interested audience.

f) *Heredity*. Emphasis is placed here on an understanding of human heredity about which there is little experimental data, but a good deal of statistical treatment. Work on Drosophila is introduced to understand the nature of the chromosome and genes. But greatest emphasis is placed on the type of knowledge needed to understand human inheritance. Work on blood types is used to show the treatment required. In spite of the inadequacy of the data, this is more satisfying to students than is the traditional treatment solely in terms of Mendelian genetics. This work on heredity is basic to an understanding of man's increasing control of biologic production.

g) *Evolution and Anthropology*. The work on evolution is motivated by students' questions on races and their significance. After a study of the biological factors underlying race, most students are ready to agree with Castle, that the problem of race is no more a biologic problem than is the problem of breeding rabbits a social one.

h) *Biologic Production*. Except in farm areas, students appear to have little initial interest in this aspect of work. But in cities especially there is a need for a sympathetic understanding of the methods and lives of the custodians of biologic production—our farmers. It is clearly the teacher's responsibility to motivate student interest in a topic which is one of the vital problems or "needs" of our civilization. City students are interested in biologic production, but apparently not in soil, photosynthesis or conservation—as discrete units. Soil chemistry, photosynthesis, genetics in relation to breeding, conservation of natural resources are generally discussed here.

THE EXPERIENCED teacher will readily recognize that students are never initially interested in such large topics as "Life Span", or "Physiology" or "Heredity". But they ask questions which when listed and catalogued by the entire class fall into a perceptible learning pattern. For instance, they have asked such questions as—

"Why do young people have pimples?"

"Why do some children look like the father, others like the mother, while others resemble neither parent?"

"How are children born?"

"What is high blood pressure?"

"Why do some children find it hard to learn?"

"Why can't we live till 150 years?"

"Are Negroes and Japanese really inferior to whites?"

"What makes people behave the way they do?"

These questions and many others, when analyzed by the class, lead to the elaboration of the course of study, to its activities—in school and out.

As is the content, the activities in such a course are selected from their significance in the learning situation. Only a few activities need be mentioned to recognize their essential nature. In nutrition, for instance, testing for protein, carbohydrate and fat yields little significant data to be used in solving problems. But measurement of the amount of vitamin A and C in different foods and different priced brands of the same food is useful laboratory work for several days. In a study of heredity students do their own blood typing and by typing their parents attempt to analyze their heredity. In the unit on Biologic Production, students do core tests of the soil in the community and make suggestions for improvement. In studying excretion, students test their own urine and learn to make simple

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Science Clubs at Work

Edited by MARGARET E. PATTERSON
Secretary, Science Clubs of America

• A department devoted to the recognition of the splendid work being done by science club members and their sponsors. Material for this department, such as student made projects; demonstrations and posters; outstanding club programs; state and regional meeting announcements; should be sent to Miss Patterson, Science Clubs of America, 1719 N Street, N. W., Washington 6, D. C.

Junior Scientists Assembly

HERBERT ZIM
Ethical Culture School
New York City

IT'S THE essence of all science to turn directly to nature for answers to problems. No matter what the opinion of experts may be, the ultimate scientific answer comes through experiment or observation from the phenomenon itself. It was undoubtedly this scientific spirit which lay behind the organization of the Junior Scientists Assembly. Though the assembly during its organization and initial meeting took on a wider significance, it was, in essence, an experiment in science education.

There is no need to recall at this time the great dislocation of scientific personnel which has resulted from the past war. There were warnings of this disaster in some of the early criticisms of the Selective Service Act. Vannevar Bush emphasized the problem in his widely publicized report. The recognition of the problem and of its importance to a country such as ours did not automatically provide a solution. The problem is still far from solved and we must look to continuing shortages of doctors, engineers, dentists and chemists. In teaching and particularly in the teaching of science the problem is becoming even more critical.

During the Fall of 1946, the Executive Committee of the American Association for the Advancement of Science, urged by Otis W. Caldwell, considered the problem in its broader aspects. A concern was felt about the problems of the young scientist and of young people entering the field of science. This concern found expression in the organization of a committee to set up a Junior Scientists Assembly at which, through the participation of these young people, the special problems of young scientists could be considered. Dr. Morris Meister was appointed chairman of the committee* which decided to hold the first meeting of the Junior Scientists Assembly in conjunction with the Boston meeting of the AAAS. This decision was an impetuous one. Time was so short that organizing the meeting was only possible because of the close co-operation of committee members and others concerned.

THE SHORTAGES of scientific personnel and the related problems of training scientists suggested the theme for the first meeting of the Junior Scientists Assembly: "The Young Scientist Looks at Education and at His Work." In selecting this theme the committee turned directly to the group which had suffered most because of war dislocations of science education. It sought suggestions on the problems of scientific personnel from those who are part of this shortage phenomenon. How do young people themselves feel about their training and about opportunities and responsibilities in the field of science? How do they think they can be more effective in filling the educational gap the war has created? To get the reactions of such a group, members of the committee were asked to in-

*The committee on the Junior Scientists Assembly consists of:
Otis W. Caldwell, representing the AAAS.
Mary Creager, representing Junior Academies of Science.
John C. Hogg, representing science clubs in independent schools.
Morris Meister, representing The National Science Teachers Association.
Hugh C. Mouldoon, representing college science teaching.
Margaret E. Patterson, representing Science Clubs of America.
John W. Thomson, Jr., representing university interests in state-wide science clubs.
J. Herbert Ward, representing science clubs and public schools.
Herbert S. Zim, Director Junior Scientists Assembly.

Leaders of Junior Scientists Assembly. Left to right (front row)—Charles Lipton, Harvard; Anna Hagopian, Radcliffe; Marina Prajmovsky, Yale Medical School; Abraham Schweid, Cornell. Left to right (back row)—Dr. Herbert Zim; Roy J. Glauber, Harvard Graduate School; Barton Brown, MIT. Misses Hagopian and Prajmovsky were top girl winners of the 1944 and 1942 (respectively) Science Talent Search for the Westinghouse Science Scholarships. Mr. Schweid and Mr. Brown were winners of Westinghouse Science Scholarships in the 1946 and 1942 (respectively) Science Talent Search.

Courtesy of Boston Globe

vite to the Assembly any young men and women whose activities and interests in science indicated that they were on their way to professional science work. The committee was interested in finding young scientists who were far enough along in their education so that they could evaluate their position, yet near enough to the problem of getting a start in science to be fully aware of the difficulties. The committee sought to obtain such young men and women from the senior classes in high schools and from colleges. Because of the location of the meeting and limited funds available, the committee concentrated on the Boston area, and all participants in the assembly came from within three hundred miles of Boston. The contacts with college undergraduates proved most fruitful. It was decided to focus the Junior Scientists Assembly at this level, but to obtain representation from secondary schools also.

Acceptances to invitations by members of the committee came directly to me. Nearly everyone invited accepted with enthusiasm. A simple questionnaire filled in by each person who accepted gave a brief picture of the background of the person and of his interests, activities, and present status in science.

THE FINAL group consisted of twenty-eight members: twenty-six men and two women. We were able to hold a brief preliminary meeting in Boston, early in December, so that the participants, attending school there, had the opportunity to meet and to discuss briefly some aspects of the program. A similar meeting was held in New York. As a result of these meetings, the committee obtained a fairly clear idea of the interests and problems of these young scientists and shaped the program accordingly.

Individuals were invited because a committee member felt that the young person was a potential scientist. The questionnaire showed that a very homogeneous, high calibre group had been selected. There is no need to point out that the questionnaire data from such a limited group do not constitute research findings. Yet in many respects they bear out previous research data on interests and activities of young scientifically-minded people.*

The age of the participants ranged from 16½ to 22, averaging 18.6 years. Ten attend Harvard; six, M.I.T.; five, Columbia; three, Yale; two, Cornell; and one each from Princeton and Radcliffe. Three participants were in graduate schools. The rest were distributed through the undergraduate years with a slight preponderance of freshmen and sophomores. Nearly half the group was working in the fields of bio-chemistry and medicine. A third was engaged in physics, electronics, and engineering. About ten percent were potential mathematicians. The rest were in chemistry, astronomy, and forestry.

*Herbert S. Zim, *Science Interests and Activities of Adolescents*, 1940, Chap. XI.

A number were winners of Science Talent Search Awards and similar honors.

THE MEETING of the Assembly, held on Friday afternoon, December 27th, drew an audience of over 200 scientists and science teachers. Members of the assembly were guests of honor at the annual luncheon of the N.S.T.A. on Saturday. Secondary schools were represented as well as the participants from the colleges: Phillips Exeter Academy, Phillips Academy, Fieldston School, Classical High School and the New Haven High Schools. Following a brief introduction by Dr. Meister, Charles Lipton (Harvard '48) took over as presiding officer of the session. He introduced five members of the assembly, who spoke briefly on research work in which they had already participated. Marina Prajmovsky (Yale Medical School) reported on Physiological Studies of the *Effects of DDT on the Nerves of the Rat.* Abraham Schweid (Cornell '50) told of his results in testing the anti-bacterial effects of onions and garlic, work which he did while still in high school. Barton Brown (M.I.T. '49) participated in research on high frequency radio skip distances, which produced data that are now important in achieving most effective long distance radio communication.

In 1945 Miss Anne Hagopian (Radcliffe '47) had the opportunity to measure the light of a new star which flared up in the constellation Aquila. Miss Hagopian told the assembly of this interesting research. The final speaker, Roy J. Glauber (Harvard) could not report on the details of his two-year research with the atomic bomb project at Los Alamos, New Mexico. But he did bring to the meeting a clear and thoughtful analysis of the implications of that research, and he impressed everyone with his earnest plea for a concerted effort to solve the problems that this phase of atomic energy has created.

THE ASSEMBLY then took the form of a panel discussion in which members covered all phases and implications of the theme of the meeting. Opinions were spontaneous and there were views which involved strong and sometimes heated differences. The audience, by its applause and interest, showed its appreciation of the opinions of the panel members and of the fresh, precise way in which these young people expressed themselves. The challenging task of recording and summing up the panel discussion fell to me and while I wasn't able to do justice to the meeting, I have retained enough notes to present the gist of it.

The panel started on how people became interested in science in the first place. The questionnaire had indicated that all members of the assembly started with an early interest in science. The average age of their first science activities was 10.5 years. At that time their interests centered on simple chemistry, microscopy, photography, geology and astronomy. From these centers, their present science interests developed. Individuals reported becoming interested in science at school and through pets, toys and apparatus at home. Some began through the scouts, clubs, and other extra-curricular activities. But nearly all were actively working with science materials long before they had taken their first high school courses. Because of this early start, and because of their intense interests, these young people have done far more with science than their classmates.

THEY NEEDED and obtained help in their science activities: often from their science teachers, sometimes from their parents. Most had some place at home where they could experiment. Many spent their spare time in the school laboratory assisting the science teacher and sometimes doing extra experiments or working on their own projects. While teachers and parents were a source of help, there was a negative aspect, too. Parents were often far from tolerant when their offspring brought white mice home or spilled chemicals on the kitchen linoleum. The participants reported that though most of their teachers wanted to help them, their programs were often so crowded that they could not. Some felt that their teachers were not able to keep up with recent developments in science and could not help them with the more advanced problems which caught their interests. The criticism was not so much on the intent of the science teachers, but on curricula and schedules, which did not permit the teachers to give these science-interested individuals as much help and guidance as they desired. The mem-

bers of the panel did not feel that they deserved special attention at the expense of other students, whose vocational interests were elsewhere, but they did regret that the school did not offer them richer opportunities.

The panel members were even more concerned about the science courses they had taken. In most cases, they felt that the factual content of these courses was repeated at the college level, so they had little gain in this direction. They regretted the limited amount of laboratory work and the fact that most experiments were in no sense "experimental." They made an earnest plea for "a chance to make our own mistakes," in lieu of following detailed laboratory instructions. The participants were critical of the fact that science teachers were often more concerned with the neatness of notebooks and the proper form of written experiments than about cultivating habits of thinking and working more pertinent to scientific research. They all felt that in addition to regular courses, they needed much more time in the school science laboratory and they valued this opportunity when they had it. Sometimes this extra project work was achieved through club activities, but whatever the means, it was prized by this science-interested group.

INDIVIDUALS on the panel also felt that they could move faster learning research techniques and the use of mathematical tools. In general, they felt their high school mathematics inadequate and that their college work in science would have benefited if their high school mathematics had been more functional.

The group's attitude was never over-critical. They were fully appreciative of the problems of the science teacher, and of the difficulties in helping science-talented individuals, especially in small schools, where both equipment and faculty might be limited. They didn't mince words in indicating that better pay would mean better teachers. And the whole pattern of high school life for these people often revolved around the science teacher.

Moving from the immediate problems of the classroom, the group showed it felt a tremendous pressure to participate in scientific research as rapidly as possible. One sensed the urgency behind their feeling that "there is so much to be done and so much that young people can do in science." This in itself creates problems for the young scientist, who often feels the need of giving up his personal and social life to submerge himself in studies and experiments. The group was quite at odds as to the wisdom of this. Some felt it was dangerous for the young scientist to lose contact with the world around him and with the political and social problems of the times. Others stressed that a scientist was also a human being and hence could not afford to become so engrossed in intellectual pursuits that his emotional and social maturity might be affected.

By improving science education and providing guidance for young people interested in science, the effectiveness of their education can be increased. This may result in more and better scientists from that specially selected group so interested in science that they have chosen it, at an early age, to be their life work.

The panel discussion was then thrown open to the floor. Representatives of the secondary schools and teachers in the audience joined in an active discussion, which had to be interrupted to bring the meeting to its scheduled close.

THIS FIRST meeting of the Junior Scientists Assembly was an experimental one. Its clear success indicated that the meeting had touched upon vital issues in a vital way. The wisdom of the AAAS in setting up the assembly was very evident by the time the meeting was over. It also became evident that, with careful planning, the Junior Scientists Assembly might function as an effective way of making the first professional contacts for young scientists. The members of the assembly were thrilled by the exhibits at the AAAS meeting and by the professional sessions they had the opportunity to attend. This opportunity can be extended. The concomitant value of bringing science teachers into contact with a selected group of young people, who are undoubtedly future science teachers as well as future scientists, is important, too. In other years, the mutual exploration of more specific phases of science education, such as the value of laboratory work or the function of science clubs might prove of real value.

Continued on Page 42

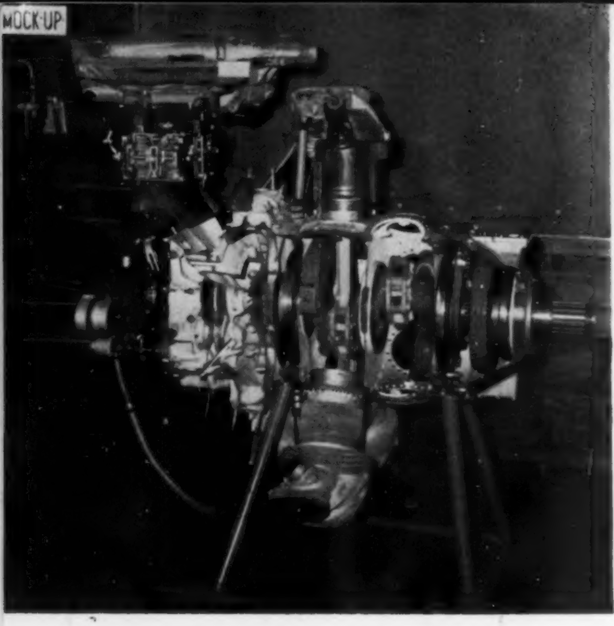


Fig. 1. Mock-up of airplane engine.

Aircraft Surplus Material

At Work in the Classroom

ALEXANDER JOSEPH

Bronx High School of Science

A WEALTH of equipment is available from the surplus stocks of the Army Air Forces and the Naval Air Service. Sales are handled by the War Assets Administration. Special prices are offered to public schools and to colleges. A complete bomber can be purchased for several hundred dollars. Many schools have beer receiving surplus equipment at no cost. In many cases the question that faces the teacher is "What to do with the equipment." The purpose of this article is to show some examples of the mounting of such equipment for school use in forms that can be operated. Such equipment is useful for the schools offering aeronautics courses as such, or for enriching courses in physics and other sciences.

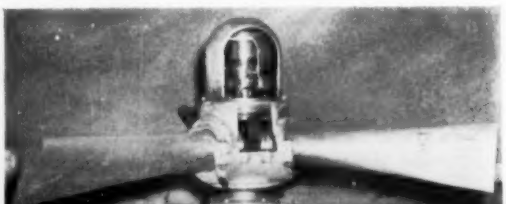
One of the most common heavy pieces of surplus equipment is an aircraft engine. There is a definite procedure to follow in changing the pickled engine in the shipping case to one useful in the classroom. Working cross-sectional models or full scale models that operate are called mock-ups. This is the term used by the Air Corps. In industry the term has a different signiifcance.

THE FIRST step in making the engine mock-up is the breakdown of the engine in such a manner that it permits easy reassembly. Disassembly at the receiving point in the school makes it easy to move the engine in parts to the room in which it will be assembled and used. Now remove the valve push rods and their shrouds (coverings). Remove the ignition harness and intake pipes. Remove magnetos, pumps and carburetor. Now remove the cylinders. If tools are available remove the crankcase but leave the connecting rods and pistons connected to the crankshaft. If you can not dismantle the crankcase use a blow torch to cut the crankcase, removing a 120 degree cut as was done to the engine mock-up shown in the photograph (Fig. 1). Cut away 120° of the nose casing. Make certain that all bearings are protected against dust and particles sprayed by the torch. If the engine crankcase can be disassembled, it may be cut with a hacksaw. If torch cutting is used, the raw edges are ground or filed to a flat edge.

Cylinders are cut only after treating the inside surface with a torch. Cutting is done with a hack saw of the keyhole type sold in hardware and five and ten cent stores. Before cutting the cylinder head portion remove the valves. It is only necessary to cut away one or two cylinders. Cut the cylinder head so that enough of the valve guides remain to permit reinstallation of the valves.

CUT OFF the connecting rods of cylinders that will not be used. Replace the cylinders that will be used and replace valves. Replace valve push rods. The engine can be made to operate without fuel by using the starter con-

Fig. 2. Propeller hub of airplane.



nected to a 24 volt storage battery. Another method is to disassemble the starter, partly exposing the inertia flywheel. A pulley is attached to the flywheel shaft. The pulley is driven by a belt drive from a 1/4 H.P. or 1/2 H.P. 110 volt electric motor. Lubricate all parts. Replace magnetos or one magneto. Replace the ignition harness. Even at low R.P.M. the spark plugs will be seen to fire. Small neon bulbs can be connected in place of the spark plugs of the cutaway cylinders to make the flash visible to a large group. The engine may be mounted on a steel or wood stand.

Propellors are among the simplest of surplus equipment to set up in working or cross-sectional mock-up form. Curtiss electric propellors are mounted on a sturdy frame. By following the instruction book which can be obtained from the manufacturer, the blade pitch can be made to work by supplying current to the slip rings of the propellers. The brush holder is shown immediately to the rear of the propeller hub in figure 2.

The Hamilton Hydromatic propeller lends itself to easy cut-way as shown in the photograph in figure 3. (See front cover.) All that need be done is to remove the dome. Cut away the soft aluminum of the dome, any amount less than half. Cut away part of the piston and part of the hub. Cut the blades off short as shown. The blades can now be used to work the piston to show the relation of piston movement to blade rotation. The blades can also be pushed to full feathered position in this manner.

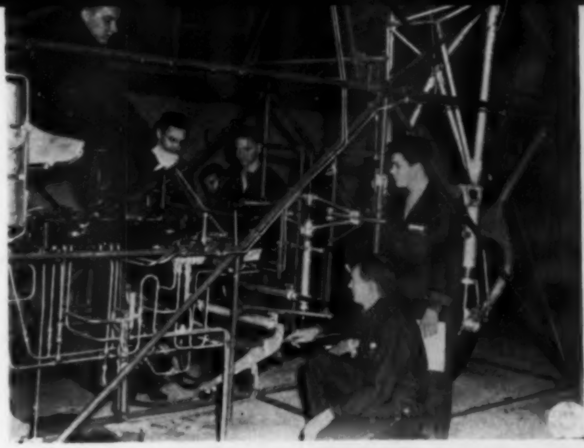
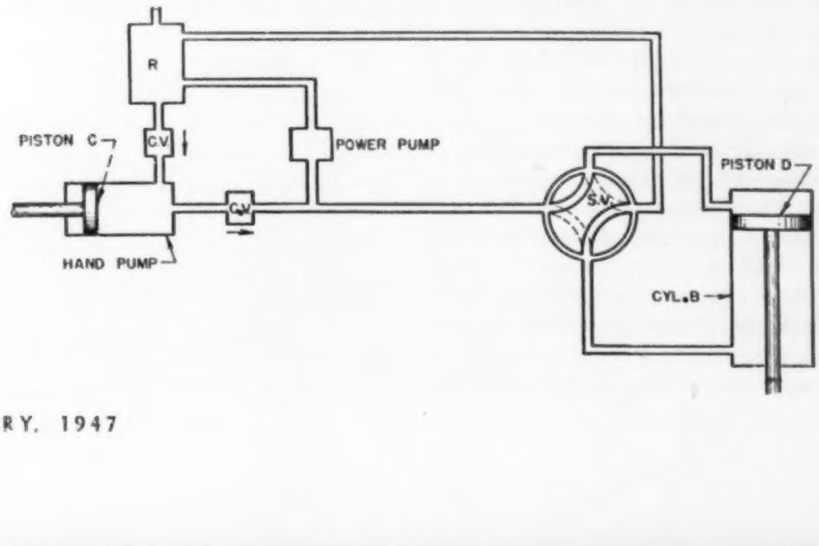


Fig. 4. Hydraulic system mock-up.

Hydraulic systems provide what is perhaps the best application of a topic studied in all physics classes and usually neglected in high school aeronautics courses. Although the photograph in figure 4 shows what appears to be a complicated system, a simpler mock-up that operates can be made from the hydraulic parts found on an airplane. The hydraulic pump is removed from the engine and is driven by a 1/2 H.P. electric motor or larger, rated to operate on the house current. The pump must be fastened rigidly and a hose and two hose clamps used to connect the pump to the motors. Use the aluminum tubing from the airplane. A flaring tool can be borrowed from a garage or a school shop. A simple hydraulic circuit is shown in figure 5. Petroleum base hydraulic fluid must be used. Thin automobile oil may be used if necessary.

Fig. 5. Below is shown a simple hydraulic circuit. Either the hand pump or power pump can be omitted. R is reservoir (oilcan); C. V., check valve; S. V., selector valve.



A Message From the Elementary Science Editor

DWIGHT E. SOLLBERGER

TWO HUNDRED YEARS LATE

ALMOST two hundred years ago, in 1749, the following appeared in "Proposals Relating to the Education of Youth in Pennsylvania" written by Benjamin Franklin. It was written originally by Mons. Rollin who wrote four volumes entitled "The Method of Teaching and Studying the Belles Lettres".

". . . That much of it falls within the capacity of all sorts of persons, even of children. It consists in attending to the objects which nature presents us, in considering them with care, and admiring their different beauties, etc. Searching out their secret causes indeed more properly belongs to the learned.

"I say that even children are capable of studying nature, for they have eyes and don't want curiosity; they ask questions and love to be informed; and here we need only awaken and keep up in them the desire of learning and knowing, which is natural to all mankind. Besides this study, if it is to be called a study, instead of being painful and tedious, is pleasant and agreeable; it may be used as a recreation, and should usually be made a diversion. It is inconceivable how many things children are capable of if all the opportunities of instructing them were laid hold of, with which they themselves supply us.

"A garden, a country, a plantation are all so many books which lie open to them; but they must have been taught and accustomed to read in them. Nothing is more common amongst us than the use of bread and linen. How seldom do children know how either of them are prepared, through how many operations and hands the corn and flax must pass before they are turned into bread and linen. The same may be said of cloth which bears no resemblance to the wool whereof it is formed any more than paper to the rags which are picked up in the streets; and why should not children be instructed in these wonderful works of nature and art which they every day make use of without reflecting upon them?"

It seems appropriate that in beginning this section on Elementary Science that we look backward over the path we have come to better see whether we have been on the right path.

Continued on Page 40

DWIGHT E. SOLLBERGER

Our new elementary science editor, Dr. Dwight E. Sollberger, has been selected for onr staff because of his broad interests in science and his background of experience. Among his interests are: scientific literacy for all people, recreational use of natural history, outdoor education, conservation of biological resources, zoology, ornithology, and teacher education in biology.

He has served as membership chairman in Pennsylvania for the National Association of Biology Teachers, a director of the American Nature Study Society and at present is editor of the Nature Study Newsletter for that association. In the National Science Teachers Association he is a director; also he has edited the last two Yearbooks for the association.

Dr. Sollberger completed his training in science at Cornell University in 1938. He has taught both in the high school and teachers college. At present he is acting head of the biology department of State Teachers College, Indiana, Pennsylvania.

This and That

NORMAN R. D. JONES
Vice-President and Membership Chairman

Dr. S. Francis Howard, Norwich University, North Field, Vermont recently retired after 50 years of active teaching.

Dr. L. K. Dorbaker, 424 Franklin Avenue, Pittsburgh, Pennsylvania recently retired from teaching.

Mr. J. E. Galbreath, Southern Illinois Area Director, has been elected President of the Cahokia Nature League, meeting monthly. This organization is composed of Nature lovers of St. Clair County.

Dr. Addison Lee of the University of Texas was elected President of the Texas Association of Science Teachers, an N.S.T.A. affiliate. Miss Greta Oppe, N.S.T.A. Regional Vice-president, was re-elected Secretary of the Texas organization.

Mr. Ray Gilbert, Utah Director for N.S.T.A. is President of the National Pigeon Association. On December 1st he began his new work, teaching at the University of Utah.

H. W. Baker reports that he is well satisfied in his new position at Sacramento, California.

Dr. Philip G. Johnson is in Germany, having been loaned to the U. S. Office of Military Government for two months to serve as an expert on instructional aids.

Meetings

Mr. James M. McArthur, Louisiana State Director, successfully reorganized the "Science Section of the Louisiana Teachers Association" at its meeting at Shreveport on November 26th. Mr. Stanley Fitzpatrick, Frontier H. S. of New Orleans, was elected president. 19 additional N.S.T.A. memberships were received. This fine group voted affiliation with N.S.T.A. We are happy to welcome this group.

Miss Frances Dunbar organized the Science Teachers of Baton Rouge and reports that 17 of the 25 science teachers now are N.S.T.A. members. They meet every 6 weeks.

Mrs. Myrtie O'Steen Baker, Secretary of the 5th District Science Division of the Georgia Education Association, reports a very fine and profitable meeting. Mr. Alvin L. McLendon reported fine meetings in other districts. Their State Association meeting will be held April 25th or 26th.

Northern and Southern California Science Teachers Associations each recently held very fine meetings. They have 118 and 44 N.S.T.A. members, respectively.

The Nebraska Science Teachers Association will hold its annual meeting May 2 and 3.

New Directors

Mr. Robert G. Whittemore, Box 124, Carson City, Nevada.

Mr. Charles E. Harkins, Bel Air, Maryland.

Miss Ethel M. Weymouth, High School, Wells, Maine.

Mr. Lee R. Yothers, Rahway Public Schools, Rahway, New Jersey.

100 Per Cent Schools

Schools reporting 100 per cent membership are: Ball High School, Galveston, Texas—Greta Oppe; Cedar Rapids, Iowa—Joe Stolar, new co-state director; and Rahway, New Jersey—Lee Yothers, new state director.

Membership

Have you checked the other science teachers in your school and area to see if they are members of N.S.T.A.? We now have approximately the same number as last year. Many new members are on our list which means that the renewals of several have not been received. *Let's put forth every effort to double our membership.* Your help will be appreciated.

Our Boston Meeting

Those of you who were unable to attend our meeting in Boston December 26-30, missed an excellent meeting. Dr. Meister, our president, is to be congratulated on the exceptionally fine meeting that he and his co-workers presented.

The next A.A.A.S. meeting is scheduled to be held in Chicago next Christmas. Why not start now planning to be in attendance?

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News and Announcements

Journal Recognized

LISTED IN EDUCATION INDEX

We are pleased to announce that *The Science Teacher* is now listed in the Education Index, beginning with the October, 1946 issue. This recognition of merit we appreciate and trust that the quality of material published will continue to improve.

Both authors and readers will appreciate the analytical service provided by the Education Index, as it will make journal material easy to find and use.

The following letter from the H. W. Wilson Company confirms the listing.

The Science Teacher
201 North School Street
Normal, Illinois

Gentlemen:

We received your letter of December 14th and are pleased to inform you that beginning with its October, 1946 issue your periodical *The Science Teacher* will be regularly analyzed and indexed in the Education Index. The first entries will appear in the forthcoming January, 1947 number of the Index.

Sincerely yours,
The H. W. Wilson Company

J. E. Kramm
Editorial Correspondence

JK:GS

Illinois Chemistry Teachers

Mr. Walter E. Hauswald, president of the Illinois Association of Chemistry Teachers, has announced that the association will hold its annual meeting at Bradley College Polytechnic Institute in Peoria in conjunction with the meeting of the Illinois State Academy of Science. Whether the meeting will be May 2 or May 3 will be announced later. Both the Keystone Steel and Wire Products Company and the Northern Regional Research Laboratory are available for field trips.

Wanted—A Name

For many years *The Science Teacher* has distributed science project booklets, books, and other helps in demand by teachers and has used much of the income in the past to help meet the cost of service to associations and to improve the journal. These materials are in no way publications of the associations we serve. In order to avoid confusion as to sponsorship and in view of publications now being offered by the National Science Teachers Association, it has been suggested that our publications be offered under a separate company name. This arrangement we accept; and now we are in search of a company name.

Just to make the choice of a company name interesting to us and also to you we invite your suggestions. The name will be used for advertising in the April issue.

We have no large sum of money for awards for suggestions, because our publishing income has gone largely for service; but we can assure each contributor a full share of our appreciation for the thought given to our needs. Write at once. A post card will do.

Another Whitman Text

To Professor Walter G. Whitman, retired head of the physical science department of Salem Teachers College in Massachusetts, congratulations are due for the physics text he has recently written in collaboration with A. P. Peck, managing editor of the *Scientific American*. The book has just been published by the American Book Company and is reviewed elsewhere in this issue.

Professor Whitman is known widely as the founder and editor of the *General Science Quarterly*, which later was changed in name to *Science Education*. He is also a co-author of a series of science books for the seventh, eighth, and ninth grades.

Commercial Exhibits at Boston NSTA Convention

Exhibits of teaching aids from industrial firms and bookmen at the NSTA convention at the Massachusetts College of Pharmacy in

Boston on December 30, 1946 proved a popular feature. Well over 200 teachers of science attended and each one left with an armload of commercial pamphlets and materials for classroom use. In addition to the several stacks of "hand-out" pamphlets, many samples of materials available upon request were displayed. Over twenty firms had representatives present to confer with teachers. Moving pictures from industrial sources and playbacks of radio scripts were also shown as part of the exhibit.

The cooperation of the Boston Better Business Bureau in preparing the exhibits accounted for a large measure of the success of the project. Several teachers suggested that a larger and a continuous exhibit be incorporated in the plans for the December, 1947 NSTA convention in Chicago.—ECW

National Council of Elementary Science

Dr. Glenn O. Blough of the U. S. Office of Education announces there will be a regional meeting of the National Council on Elementary Science in Chicago, March 22, at Hotel Sherman. Speakers on the program include: Dr. Wilbur L. Beauchamp, University of Chicago; Professor Daisy Parton, University of Alabama; Professor W. C. Croxton, State Teachers College, St. Cloud, Minnesota; and Dr. Gerald S. Craig, Teachers College, Columbia University.

One panel will discuss "Some of the Most Effective Methods of Instruction in Elementary Science"; another will discuss the changes in the elementary science program suggested by the 46th Yearbook.

New Jersey Science Meeting

The next meeting of the New Jersey Science Teachers Association is March 8 at Montclair State Teachers Colleg. The program is in charge of Miss Thelma Maginnis, northern vice-president of the association. A later meeting is to be held in May. At this time there will be a field trip; the program will be in charge of Mr. James A. Starkey, the southern vice-president.

Cooperating Associations

New Jersey Science Teachers Association

William E. Price........President
Scott High School, East Orange, N. J.
Thelma Maginnis........Vice-President
Arlington High School, Arlington
Victor Crowell........Vice-President
State Teachers College, Trenton
James A. Starkey........Vice-President
High School, Vineland
Helen A. Clarke........Recording Secretary
High School, Newark
Robert H. Carleton........Corr.-Sec.-Treas.
High School, Summit, N. J.

Texas Science Teachers Association

Addison Lee........President
The University of Texas, Austin
Greta Oppe........Secretary
Ball High School, Galveston, Texas

California Science Teachers Association, Northern Section

J. A. Perino........President
High School of Commerce, San Francisco 2
Maury Gould........Vice-President
Albany High School, Albany
Winifred Smith........Secretary
Castlement High School, Oakland
Anne Bigler........Treasurer
Sequoia Union High School, Redwood City

Southern California Science Teachers Association

Garford Gordon........President
Susan Miller Dorsey High School, Los Angeles 16
Marion Taggart........Vice-President
La Cumbre Junior High School, Santa Barbara
Rollin O. Enfield........Secretary-Treasurer
Pomona High School, Pomona, California

National Association for Research in Science Teaching

Earl R. Glenn........President
State Teachers College, Montclair, N. J.
E. S. Obourn........Vice-President
John Burroughs School, Clayton, Mo.
C. M. Pruitt........Secretary
Oklahoma A. and M. College, College Station, Stillwater, Okla.

(Note: Officers of Illinois Association of Chemistry Teachers and of Iowa Association of Science Teachers will be found in the October issue.)

Correction

In the letter of Elbert C. Weaver to Frank B. Wade that appeared on p. 88 of the December, 1946, *Science Teacher*, the third paragraph should read:

The concentration of sulfide ions from hydrogen sulfide is in the order of magnitude of 10^{-22} moles/liter in a saturated solution. Under similar conditions O^{--} ion has a concentration of 10^{-100} m/l. Hence the O^{--} ion has too low a concentration to be effective and to act as does the sulfide ion.

A High School Mechanical Teaching Device

MAX EPSTEIN

New Utrecht High School
Brooklyn, New York

THE MECHANICAL device here shown can be used for the high school teaching of (a) atomic structure, (b) oxidation and reduction, (c) electron transfer and formation of an electrovalent compound, and (d) electrolytic dissociation.

Procedure

A. When the sodium and chlorine atoms are separated, they represent atoms of these elements with atomic structure as indicated in the model below. The sodium atom has one electron in the outermost ring and the chlorine atom lacks one electron of having its outer ring complete.

B. To show oxidation and reduction, shift the outermost (movable) electron of the sodium atom to the empty electron space of the chlorine atom.

$Na^{\circ} - 1\,e \rightarrow Na^{+1}$ Oxidation

$Cl^{\circ} + 1\,e \rightarrow Cl^{-1}$ Reduction

C. To show compound formation of sodium chloride, slide the chlorine atom (disk) to the left. Its vacant electron groove will now fit the outermost electron of the sodium atom and thereby complete the outermost ring of chlorine. $Na^{\circ} + Cl^{\circ} \rightarrow Na^{+1}\,Cl^{-1}$

D. To dissociate the NaCl formed above, move the chlorine disk with its acquired electron to the right. $NaCl \rightarrow Na^{+1} + Cl^{-1}$

In the mechanical model represented by the diagram below the sodium and chlorine atoms are represented by cardboard disks; the nuclei are of cardboard and attached with glue; the electrons are made of cork and colored red. In the back of the movable cork electron of sodium is a tack for sliding in a groove. A small place is cut out of the chlorine disk to receive the movable electron. The chlorine atom is also movable and slides in the groove indicated by the dotted line. The base for the atoms is a cardboard three feet square.

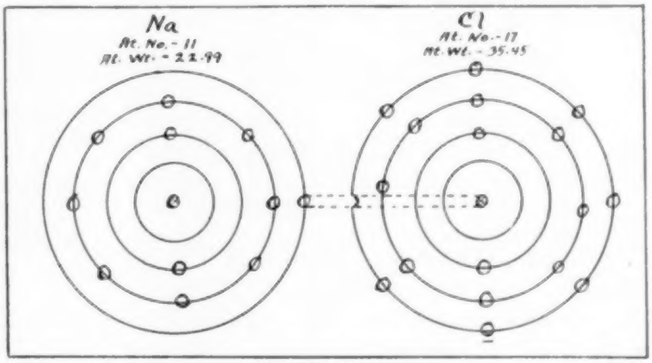

Diagram shows arrangement of device. The number of neutrons and protons can be shown in center ring representing nucleus.

THIS AND THAT

Continued from Page 31

Summer Meeting

The next N.E.A. meeting will be held at Cincinnati, Ohio, July 7-11. This will again be a limited meeting as at Buffalo last year due to lack of hotel accommodations. However, it is suggested that you contact your N.E.A. Local, District or State Association organization and secure an appointment as a delegate to the N.E.A. Representative Assembly. Then you can be there to participate in our meeting also. *We will be looking for as many of you as can be there.*

Yearbook

A Typical Expression: Ashton G. Varnedde, Savannah, Georgia who purchased 25 extra copies, says, *"The Yearbook is an extraordinarily fine piece of work.* It gives us something to work with locally".

Any wishing extra copies may secure them at 50c each either through the writer or preferably from 1202 16th Street N. W., Washington 6, D. C.

REORGANIZING BIOLOGY

Continued from Page 23

clinical tests. The class as a group may engage in a cancer campaign, or a food saving campaign, or "publish" a pamphlet on "The Problem of Race". They do experiments in learning and discover for themselves the laws of learning. They analyze statistical data and find "vital statistics" especially fascinating. They learn to apply valid data to the solution of problems which concern them—to problems of longevity, of smoking, drinking, soil conservation, and race. They have the opportunity to learn the limitations of argument as well as of scientific methods.

REORGANIZATION in biology teaching must result in the individualization of instruction so that our future biologists may have opportunity to find their metier. The Bush Report "Science, The Endless Frontier," emphasizes this function of secondary science. These embryo scientists need be selected early and given a "corner in the laboratory" where they may take the mental and manual exercises which distinguish the scientist. At Forest Hills High School, we select them in this way. In the freshman year in General Science, students who show promise are given an opportunity to join one of the many club activities. There they are watched carefully. In the second year they are attached to teachers who will "sponsor" and advise them. In the biology course they will be segregated in an "honor class" where they will be stimulated by others who have similar abilities. The work in this course is of a more difficult nature, and will permit of more abstract work than does the regular work in biology. If an honor student sustains the promise he showed, his club and school program is planned so that he gains skills in the use of hand and machine tools, learns how to use such laboratory equipment as sterilizers, analytical balances, the microtome, and electric oven. He becomes really expert in the use of the microscope. At the same time, in his junior year he is permitted to select an "original problem". This is a problem about which there is little information available to him under the conditions of high school science. One stu-

dent may work on the effect of CO_2 and O_2 on sporulation in molds, another on latex organisms, another on digestion in amoeba, still another on "sporting" in Coleus. One student now is working on a new rust in Echeveria. With the advice and encouragement of his "sponsor" he sets about solving the problem. He learns scientific methods. He tries to acquire the peculiar type of persistence, courage and working habits of the embryo scientist. In his senior year he reports on his work (presents a paper) at a Science Congress. Before this, he presents his paper at a seminar before the Research Club and Science-Math Honor Society. He learns to take criticism, to get more data, to be careful in his conclusions. Approximately 10-20 students per term are graduated from our high school with this type of intensive training.

IN ALL OUR classes in science, however, all students should get a real appreciation of scientific method. This I contend cannot be done in most schools because teachers are wedded unconsciously, it is true, to unscientific method. Visit almost any science class in the nation and the evidence to support this statement will present itself wherever a teacher shows photosynthesis in *one* leaf, diffusion through *one* membrane, saliva digesting starch in *one* sample. The same happens to be true in many chemistry and physics classes. But such teachers are quick to challenge a student who comes to the conclusion that the Irish are drunkards, or that Italians are excitable, on the basis of one observation. The teacher rightly calls for more data. But all term the teacher has been guilty of precisely the same unscientific method which he now detects in his students.

It is not implied here that the students are perspicacious enough to see this error in teaching method, but it is contended that constant emphasis on adequacy of reliable data in number of cases as well as accuracy will do much to teach the practical aspects of scientific thinking. The gravest errors on scientific thinking are committed by those who reason from one experiment or one experience. Most misapprehensions with regard to racial and religious matters are due to this type of reasoning. I do not wish to imply a transfer of training. But whether there is transfer or not, there is no need for supporting unscientific method in the science classroom.

IN THIS brief treatment of a very wide field, I have attempted to sketch the lines along which reorganization in biology might conceivably go. Philosophy, content, method and laboratory practices have been mentioned. Other aspects such as the type of teacher training required, types of textbooks and equipment needed have not been treated.

It is my belief, at present, that the type of reorganization which may be most far reaching in its effects and most useful in a society where science and scientists are changing our culture pattern, is one where biology, chemistry and physics are fused in a single science. This science will be organized around problems of living, not around units of subject matter. This science will be a continuous experience, throughout the four years of high school. Acting on this belief, I have organized such an experimental course at the Forest Hills High School, with the blessing and cooperation of our administrative staff. It is being subjected to valid experimental procedures. It has been progressing for one year. Some results will be available soon. The advantages and obstacles are obvious. Some of these have been described in a recent article.[3]

One of the most necessary single steps in the reorganization of science teaching will come, it seems to me, when science teachers apply the scientific method to science teaching itself. There is very little data derived experimentally upon which science teachers may build. There are very few courses which have been based on experimentation in the scientific sense. Many of my remarks here have, therefore, of necessity been in the nature of speculation; I have offered opinions based on personal experience and other teachers' experiences. This is testimony but not evidence.

It is hoped that science teachers will follow the route of the development of scientific method—from argumentation and speculation, to experimentation. Only then may our reorganization of science teaching be sound.

3—Four Years of Science, Brandwein, Paul F. Science Education, Feb., 1945, Vol. 29, p. 29-35.

SCIENCE FOR FREEDOM

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are done from the actual writings of the scientists.

THE SECOND semester is divided into the following areas: (1) some of the technological possibilities in food, clothing, shelter, health, power and control; (2) the important and urgent needs in these areas; (3) the forces, economic, political, religious and educational, in our western culture, both institutional and personal, that are either helping to develop the technical possibilities to meet the needs or that are interfering in this process; and (4) a unit devoted to an examination of the role of the citizen as a scientist and the scientist as a citizen.

Cooperating parents and alumni lectured on clothing manufacture, health, minority problems and religion. The students find the visiting speakers and discussion leaders stimulating. They begin to see their teachers in new roles, not as subject matter specialists, but as people whose specialty is related to the economic, social and intellectual life of the past as well as the present.

The guest teacher who is asked to prepare for a discussion, demonstration or lecture knows that in forty minutes he or she is to emphasize the most important generalizations of the specialty in relation to a given cultural era. So that all the visiting contributors have given unselfishly of their time in planning and the results have been marvelous. All of us who have some job to do in this cooperative venture have benefited spiritually and intellectually.

IN OUR planning and valuation we have found the following outlines from an article, "Science and Culture," by Lawrence K. Frank, in Scientific Monthly, June, 1940, very helpful as a frame of reference.

A. Persistent life tasks of man

1. To come to terms with nature in order to gain sustenance, to find security, and to achieve survival in a world both precarious and problematic.

2. To organize a group life so that individuals can live together and participate in the division of labor, which group living both necessitates and makes possible.

3. To transform organic functioning and impulsive behavior into the patterned conduct of group life and of human living as distinct from biological functioning.

B. The four organizing basic conceptions of man

1. The nature of the universe; how it arose, or was created; how it operates; who or what makes things happen, and why.

2. Man's place in that universe; his origin, nature and destiny, his relation to the world; whether in nature or outside nature.

3. Man's relation to his group; who must be sacrificed for whom; the individual's rights, titles, duties and obligations.

4. Human nature and conduct; man's image of self and his motives; what he wants and what he should have; how he should be educated and socialized.

SOME readers may think that we are spreading ourselves rather thinly in introducing so many concepts in such a short period of time. Perhaps, but the results on tests seem encouraging. The students are apparently getting the important generalizations. It is also made clear by all that no one after a year in such a course can consider himself an expert. This is only the beginning of a deeper understanding of the interaction of science and society. We on the staff also feel that we are grappling with the challenges existing in our present day world and are going a bit further than we did before in our other courses in coming to terms with these problems.

Perhaps a new course is not the only answer to a clarification of our present dilemma. Or, maybe, the study of science and its impacts is like sex education, in which you can't do it all in one course at one time. Yes, there are many ways. But out of this work in our school will surely come a different emphasis in the way we do our science teaching, as well as our other teaching together. It is hoped that readers who are working along these lines will communicate with the writer. Perhaps we can share experiences and thereby improve our work. This cooperative venture has enriched the writer's teaching in other areas and has been a most stimulating experience.

ELEMENTARY SCIENCE

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TODAY as never before we are obligated to maintain in the child his almost insatiable curiosity toward his surroundings as well as to create interest in those areas which his busy mind has overlooked. There is little doubt that teachers may dull this curiosity instead of leading it on. First hand experiences leading to an understanding of a method of securing more knowledge are of greatest importance in the early years. Second-hand and third-hand information should be held in abeyance in the early years until the meaning of good and bad sources of information is understood.

It is hoped that this section of *The Science Teacher* will become a cooperative pooling of efforts of all those interested in seeing a strong elementary science program in all schools. To this end your editor invites articles dealing with the many problems of the science program at the elementary level. Of particular importance are concise articles dealing with children's activities which lead him to the answers to his questions about things which he sees and which point the way to further activities. "Thing learning" should be the keynote for such articles.

Your editor will attempt to secure a balanced presentation through selecting activities dealing with all fields of science.

Other problems which should receive attention are:

The preparation of the elementary science teacher.

In-service training for the elementary science teacher.

Finding time for elementary science.

Bibliographies for elementary science teachers and pupils.

Cheap and easily obtained materials for elementary science programs.

The elementary science room.

Curriculum in elementary science.

Articles should be from 600 to 900 words in length and may be sent to the Elementary Science Editor, care of this publication or directly to him at State Teachers College, Indiana, Pennsylvania.

SCIENCE PACKETS

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science. It goes without saying that having interested members in an association usually means an influx of new members.

Too, such a project related too closely to the heart of industry ultimately means the production of a finer type of informative materials for teachers and students. The resultant close cooperation between science teachers and industry means an educational program emanating from industry that is stimulating and of value in the training of the selective and superior science student. An informed teacher means better science teaching; better science teaching means a better man-product for industry. A better industry and better science teaching can raise the level of our civilization.

Perhaps this growth in a power of an association may be likened to the outlet of energy within a small radio tube. As the current moves out from the tube, it gathers unto itself more power—enough to keep the current going, and becomes a mighty communicative force. Like that power, the power of our Association beginning with the small outlet of interest energy of the teachers can move out. It, too, can gather unto itself more power, become a mighty communicative force in welding together the work of the science teachers with that of the industrial scientists. It could be such a powerful force that the productive science of tomorrow would be constructive rather than destructive.

JUNIOR SCIENTISTS

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The committee on the Junior Scientists Assembly has already decided on a second Junior Scientists Assembly to be held in Chicago during the AAAS meetings, Christmas week —1947. With more time available we can anticipate an even more representative program than the initial one, and there may also be time to develop other meetings for these young scientists, which may either supplement or substitute for the panel discussion type of

meeting first attempted at Boston.

The idea of the Junior Scientists Assembly is valuable locally as well as on a national scale. Wherever there is a community large enough so that a reasonable sized group of science-talented students can be brought together, there is a possibility of subsidiary science education of an extremely important type. The Junior Academies of Science are already working in this direction.

The science teacher has always recognized the tremendous values of science in general education. Because of this basic emphasis in science education, we have been inclined to overlook the small, but exceedingly important, group of young people who will be the scientists of tomorrow. To give these young people the attention they deserve is only proper. It is a fitting supplement to the program of general education and does not in any way conflict with it. The Junior Scientists Assembly and the subsidiary activities which may develop with it should play a vital role in this phase of science education.

Write for It

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of making of steel of many kinds. American Iron and Steel Institute, 350 Fifth Avenue, New York City.

Careers in the Electrical Industry is a 32 page booklet that indicates the possibilities ahead for youth in the electrical industry as seen by the General Electric Company. Write the General Electric Company, Attention Miss Rose Dyson, Schenectady, New York.

Air Transportation—Jobs and You. A 24 page illustrated booklet which gives information concerning many jobs in air transportation. United Air Lines, Dept. KP, 23 E. Monroe Street, Chicago 3, Illinois.

Control Manual for Heating, Ventilating and Air Conditioning. A 200 page manual describing many control systems with the type of equipment needed. Desirable for engineering classes; and of interest to physics students. Minneapolis Honeywell Regulator Company, 2753 Fourth Ave. S., Minneapolis 8, Minnesota.

BOOK SHELF

WHITMAN-PECK PHYSICS. Walter G. Whitman, formerly Head, State Teachers College, Salem, Mass.; A. P. Peck, Managing Editor, Scientific American, New York City. American Book Company, New York, 1946. 629 pp., 15½ x 22 cm. 585 illus. $3.00.

The *Whitman-Peck Physics* not only attempts to present those facts and principles of physics upon which invention, discovery and the progress of science depend, but also to lead young people to see the important role these principles play through their application in modern living. The authors have succeeded well in reaching these goals. All important principles at the high school level are included and modern applications of physics abound.

The general plan followed in presenting a unit in the text is to give first an understanding of basic principles as seen in relation to applications that are common and also challenging. This is followed by further enlargement of ideas presented by means of additional applications. For example, a study of photography follows a discussion of light.

Many interesting side lights are included that will arouse interest. Both non-mathematical as well as mathematical problems are included. The presentation is such that adjustment for individual differences can be easily made. The book is profusely illustrated and should prove interesting to every student.

CHEMISTRY FOR OUR TIMES. Elbert Cook Weaver, Phillips Academy, Andover, Mass.; and Laurence Standley Foster, formerly Assistant Professor of Chemistry, Brown University. McGraw-Hill Book Company, Inc., New York, 1947. 738 pp., 15 x 22½ cm. 411 illus. $2.48.

Chemistry for Our Times differs markedly from most high school texts. In organization a study of colloids and the earth's crust—ores, soil, and sea water—comes early in the text preceding a study of the heavy acids and heavy bases of commerce. This has the advantage of keeping the student's thinking closely related to his own environment and it does involve a simple study of some salts.

An important feature of the text is the postponing of problem solving into the second semester after the student has had ample time to master formulas, equation writing, and problem work related to determining atomic weights. This permits the student to have more time to learn the more difficult parts of chemistry and an opportunity to gain confidence in his ability in the subject.

The book has a practical approach to the theory of chemistry and gives an abundance of consumer material. Many industrial applications should make the work interesting.

HOW CAN WE TEACH ABOUT SEX? Benjamin C. Gruenberg. Public Affairs Committee, New York, 1946. 32 pages, $.10.

Dr. Gruenberg points out that sex cannot be taught as a subject, but is integrated with everything people do. All school experiences bear in one way or another on sex education, which is, to a considerable extent, a matter of character education in general. Our greatest difficulty lies in the fact that parents and teachers are seldom well enough orientated and adjusted themselves for competence in meeting this problem. Dr. Gruenberg admits that, "in spite of all the substantial gains, conditions at the close of the war find our young people—and older ones, too—more muddled than ever.' No reference is made to the problem of teaching specific sex physiology.—J. S.

VITALIZED GENERAL SCIENCE. By Barclay M. Newman, formerly Head of Science Department, Brooklyn Academy, Brooklyn, New York. Edited by Sebastian Haskelberg, James Fenimore Cooper Junior High School, New York City; and Esther Boal, Emerson High School, Gary, Indiana. College Entrance Book Company, New York, 1947. 380 pp. 13 x 18 cm. Illus. $.75.

Vitalized General Science makes use of the striking effect of two colors in many diagrams, a procedure that has proved most effective in other books of this science series for the junior and senior high schools. Important ideas are thus made to stand out by the sharp contrast.

The subject matter is organized into four sections: (1) nature of matter and how it changes; (2) application of principles, including forces which affect matter; (3) principles related to living things; and (4) the earth, sun, and stars.

At the end of each chapter are summaries of the material presented, followed by questions that will enable the student to find if he has mastered the material.

ELEMENTS OF GENETICS. Edward C. Colin, Chicago Teachers College. Second Edition. The Blakiston Company, Philadelphia, 1946. 402 pp., 15 x 22½ cm. 90 illus. $3.50.

The book is designed particularly for college students in genetics and is suited for use as either a text or reference in the subject. The large amount of material included that is related to man will make it of interest also for the general reader as well as for the high school library. The historical approach used makes it quite interesting and conditions the reader for the more technical discussions that follow.

In the second edition the author not only has included the most significant advances in the field but has strengthened and broadened the discussion in some areas. Several changes have been made in the chapter dealing with heredity in man, particularly with reference to differences in blood. The M-N Types and the recently discovered Rh blood factor has been added. The discussion of the *Gene* and *Mutations* has been revised in view of recent findings in the study of viruses in relation to genes.

SUGGESTIONS FOR THE TEACHING OF SCIENCE IN THE TWELVE-YEAR PROGRAM, State of South Carolina Department of Education, Columbia, 1946. 115 pp.

This educational bulletin is the result of a cooperative approach in building a science program for the schools of South Carolina, one hundred thirty-six school people participating in the study conferences. There are two chapters in the study, the first dealing with the purpose of general education in which skills and tools, habits, ideals, attitudes, and abilities are emphasized for the educative process which should develop democratic living by revitalizing the accumulated learnings of the human race and transmitting it to human society. The second chapter carefully makes suggestions for a program of good, sound science teaching in such an educative process. The science concepts have been grouped at the elementary level under certain big ideals that experts and public opinion consider necessary for one to become an educated man. At the intermediate level boys and girls are given broadening experiences in the area of natural science in keeping with the needs of children and society. At the high school level there is suggested material for the teaching of general science, biology, chemistry, and physics. The study concludes with an excellent bibliography on both public education and science education. This study guide for the teaching of science has within its framework a sound educational program worthy of study by those who are faced with the same problem of planning a twelve-year program in science education.

THE PATH OF SCIENCE. C. E. Kenneth Mees, Vice-President in charge of research, Eastman Kodak Co., with the cooperation of John R. Baker, University of Oxford. John Wiley & Sons, New York, 1946. 250 pages, 14 x 21 cm. $3.00.

Upon a matrix of a scholarly discussion of the classical theories of civilization's cyclical progress, Dr. Mees weaves an interesting concept in which succeeding cycles, with some overlappings and uneveness, are marked generally by an increasing rate of progress. Progress, which is cumulative, is denoted by increase in knowledge of science and its applications to the social and economic life of the time. There are interesting chapters on the method of science and the growth of science, with particular references to physical, chemical and biological ideas. With a brief description of different aspects of research and investigation, and a description of various types of research organization, the author alludes to a pressing need for increasing financial support for certain phases of research. In the concluding chapter, Dr. Mees makes a case for the inevitability and necessity for social change, under the impact of technology. Sociology, he maintains, cannot use the techniques of physical science, but can and must use the scientific method.
—J. S.

FROM GALILEO TO THE NUCLEAR AGE. Harvey Brace Lemon, The University of Chicago. Published by The University of Chicago Press, Chicago, 1946. 451 pp., 16½ x 23 cm. Illus. Text edition, $3.75; trade edition, $5.00.

As a survey text in physics for college freshmen, Professor Lemon's book, "*From Galileo to the Nuclear Age*," fills a definite need. Putting physics principles and facts in simple language and in terms of homely illustrations, it is easy not only to learn physics, but to have a delightful time doing it. The general reader who likes to understand more of what is happening about him will also enjoy reading this text.

The five sections of the book are: *Mechanics, Heat, Electricity and Magnetism, Electricity and Matter*, and *Waves and Radiations*. These divisions are treated in a challenging way, including material and ideas that lead the reader ahead, sometimes into the realm of speculation. For example, in the section dealing with mechanics some astronomy is introduced and also some speculation on tidal evolution.

Problems for the student to solve are omitted. In this type of book not everything in the field of physics can be included. However, the book is most challenging and deserves to be in every high school and college library.

ANATOMICAL CHART NO. 12. DIGESTIVE TRACT. Rudolph Schick Publishing Company, New York City. 35x44 inches. $6.75, mounted.

Chart No. 12 is a study of the human digestive tract, though no main title appears on the chart. It features a major illustration and enlargements of six details. The major illustration is a 41x16 inch enlargement of the complete alimentary tract in position in the human body. The gall bladder and its ducts are shown beneath the reflected liver. Students might question whether the vessels shown on the pancreas were part of the vascular system or whether it represented the greater pancreatic duct. Arrows indicate the direction of food movement through the tract; dissected sections of the mouth, esophagus, stomach and both intestines facilitate this, as well as to indicate internal structure. The position of the omenta might have been indicated.

The subjects of the six enlarged details are as a whole well done. The size of the entire chart is of distinct value. Further labelling would have been of value. General coloration is excellent. The chart would be a very useful educational device in high school classes, but lacks sufficient detail for advanced college classes.

Be a Joiner

(Editorial from *The Science Counselor*, December, 1946)

NO PERSON working alone can effect major changes in education even in a restricted field. But many persons working under competent direction, faithfully following a common plan toward a desired end, can accomplish much. Applied practically, this means that any significant advances in science education must come through group action.

Teachers of science are not noted as "joiners." They should be. There is much to be accomplished for science in the schools. There is much that will be lost—is now endangered—because too many science instructors work complacently at their daily tasks giving no thought to the trends in their profession, trends which they might influence if they were not self-centered.

Educators in the science field should consider it a duty to belong to those associations that work for the improvement of science teaching and science teachers. They should join the professional societies devoted to the individual sciences as well as the associations which consider all the sciences, and other great groups which further the cause of education in general. Membership in national, regional, state, and local associations is desirable. The small local association helps the teacher with his immediate problems; the great national association helps the teacher by advancing the profession as a whole.

BUT TEACHERS should not join an association merely to receive. Associations are partnerships. Members should contribute to the group as much as they get from it. The annual fee will help solve the association's problems of finance, but it is the members' attendance at meetings, their work on committees, their willingness to experiment and to speak and to write, their friendship and loyalty and euthusiasm, even courage, perhaps—it is these that make an association virile and effective.

The great *National Science Teachers Association*, an affiliate of the A.A.A.S., and a department of the N.E.A., has an ambitious program. Its large and growing membership, its vigorous policies and spirited direction insure worthwhile accomplishments. The too small fee of one dollar a year includes a copy of the yearbook and a subscription to the quarterly journal *The Science Teacher*. The address is 1201 Sixteenth Street, N. W., Washington 6, D. C.

Verbum Sap.

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